CLAIMS

What is claimed is:

1. An apparatus for measuring the current position of an object, comprising:

a magnetic sensor assembly having serially arranged therein, a magnetic field source, a magnetic field sensor, and separated pole pieces forming a first air gap therebetween;

a platen coupled to the object and moving therewith and interacting with the magnetic sensor assembly, the platen containing a first region of position varying magnetic properties that moves through the first air gap in a first direction in response to movement of the object, thereby changing the magnetic reluctance of the first air gap and the magnetic field measured by the sensor, wherein the measured magnetic field indicates the current object position.

2. The apparatus of claim 1 wherein the platen has a principal surface containing the first region and the first region comprises a magnetic material whose lateral extent in the air gap in a second direction lying approximately in the principal surface and substantially perpendicular to the first direction, varies in the first direction.

3. The apparatus of claim 1 wherein the platen has a principal surface containing the first region and the first region comprises a magnetic material whose thickness in the air gap in a third direction substantially perpendicular to the principal surface and the first direction, varies in the first direction.

4. The apparatus of claim 1 wherein the position being measured is the angular position of the object and the platen rotates as a function of the angular position of the object, and the first region lies in a principal surface of the platen and is substantially circular in shape so that the position varying magnetic properties of the first region pass sequentially through the air gap as a function of rotation of the object.

5. The apparatus of claim 1 further comprising further separated pole pieces forming a second air gap therebetween located in parallel with the first air gap, and wherein the platen has a second region of position varying magnetic properties that passes through the second air gap in response to changes in the position of the object.

6. The apparatus of claim 5 further comprising still further separated pole pieces forming a third air gap therebetween located in parallel with the first and second air gaps, and wherein the platen has a third region of position varying magnetic properties that passes through the third air gap in response to changes in the position of the object.

7. An apparatus for measuring the angular position of an object, comprising:

a rotatable platen coupled to the object so that rotation of the object causes rotation of the platen;

a first magnetic sensor assembly having serially arranged therein:

a first magnetic field source;

a first magnetic field sensor having a first output;

first and second magnetic pole pieces forming a first air gap therebetween;

a first track located on the platen and passing sequentially through the first air gap as the platen rotates, the first track having magnetic properties that vary in a first manner as a function of the angular position of the platen;

wherein the first output of the first sensor varies as a function of the varying magnetic properties of the first track, thereby providing a measure of the angular position of the platen and the object.

8. The apparatus of claim 7 further comprising a second magnetic sensor assembly having serially arranged therein:

a second magnetic field source;

a second magnetic field sensor having a second output;

third and fourth magnetic pole pieces forming a second air gap therebetween;

a second track located on the platen and passing sequentially through the second air gap as the platen rotates, the second track having magnetic properties that vary in a second manner as a function of the angular position of the platen;

wherein the second output of the second sensor varies as a function of the varying magnetic properties of the second track, thereby providing a further measure of the angular position of the platen and the object.

9. The apparatus of claim 8 wherein the first and second magnetic sensor assemblies are spaced apart a predetermined distance around the platen.

10. The apparatus of claim 8 wherein the first track has a portion whose magnetic properties vary monotonically within substantially 2π radians of rotation of the platen and the second track has a portion whose magnetic properties very monotonically over substantially less than 2π radians of rotation of the platen.

11. The apparatus of claim 7 wherein the first track is formed of a magnetic material whose radial width varies as a function of the angular position of the platen.

12. The apparatus of claim 7 wherein the first track is formed of a magnetic material whose thickness varies as a function of the angular position of the platen.

13. The apparatus of claim 7 wherein the first track is formed of a magnetic material whose magnetic density varies as a function of the angular position of the platen.

14. A method for measuring the current position of an object using a magnetic sensing apparatus having a magnetic source, magnetic sensor and at least one air gap, interacting with a platen coupled to the object and at least partly located in the air gap, the method comprising:

providing a magnetic field in the sensing apparatus using the magnetic source;

directing at least a portion of the magnetic field through the at least one air gap;

moving a stripe of material having position varying magnetic properties located on or in the platen, through the at least one air gap in response to movement of the object;

measuring the magnetic field for the current location of the platen using the magnetic sensor; and

using the measured magnetic field to determine the current object position.

15. The method of claim 14 wherein the using step comprises comparing the measured magnetic field with predetermined data on the relationship between measured magnetic field and platen position to determined the current object location.

16. The method of claim 14 wherein the providing step comprises providing a magnetic field using a permanent magnet.

17. The method of claim 14 wherein the providing step comprises providing a magnetic field using an electro-magnet.

18. The method of claim 14 wherein the measuring step comprises measuring the magnetic field using a Hall Effect sensor.

19. A position sensor for sensing a position of a moving object, comprising:

a first body adapted to flow a magnetic field therethrough, the first body having at least two poles separated by a gap across which the magnetic field flows;

a second body adapted to be coupled to the moving object and including a region that is disposed at least partially in the gap, at least a portion of the region having magnetic properties that vary with position, whereby movement of the region through the gap causes variations in magnitude of the magnetic field flowing through the first body; and

a magnetic field sensor coupled to the first body and configured to measure the magnetic field magnitude variations.